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ABSTRACT

Developed for biology students, this handbook discusses categories of various types of reference books and other information sources, and presents a step-by-step approach to the logical, systematic, and comprehensive way in which library resources may be used to locate information on the biological sciences. An accompanying bibliography lists relevant information control agencies, sources on the organization of life sciences, guides to the literature, guides to research methods, sources on the history of the discipline, science dictionaries and encyclopedias, reviews of the literature, yearbooks, guides to particular library collections, handbooks, indexes, abstracts, guides to the periodical literature, thesis and dissertation sources, research reports, conference proceedings, societal publications, guides to research in progress, guides to government documents, biographical sources, style manuals, bibliographies, guides to audiovisual materials, directories, teaching guides, and books on search strategy. (FM)

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THE ORGANIZATION OF INFORMATION IN THE FIELD OF BIOLOGY AND HOW TO GET TO IT

by

Orion Harrison

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THE ORGANIZATION OF INFORMATION IN THE FIELD OF BIOLOGY AND HOW TO GET TO IT

by
Orion Harrison
Georgia Southern College Library
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Whenever students -- or for that matter, people in general -- need to look up information on a topic, they usually think that a library would be the best and most logical place to go to find the information. Unfortunately, these information seekers generally think in terms of "digging out" the necessary information, and they approach the task with some trepidation. The fact is, however, that anyone who knows how to use a library properly can locate a mass of material on practically any topic with a minimum of effort. In most cases the problem becomes not how to find information, but how to sort through all of the available information in some logical and systematic, but at the same time comprehensive, way.

One of the biggest mistakes people make when looking for information is that they begin by searching for particular items, such as individual books or periodical articles. It is much more important first to realize that information sources on any topic fall into broad categories by function than it is to memorize particular titles. Once the nature of each of these categories is understood, it is relatively easy to decide which categories are appropriate to one's present and immediate information needs. Then particular titles within the appropriate categories can be located and used as springboards to the best and most pertinent available information on the topic.

The categories into which information sources in the field of biology can be divided will be discussed in detail, and a logical step-by-step search strategy will be indicated. The full bibliographic information on titles

mentioned in the text, as well as other appropriate titles, is given in the biology bibliography which accompanies this handout. Keep in mind that this bibliography is by no means exhaustive; there are many more items available in each category. Also remember that in addition to titles that apply to the discipline of biology in general, there are many items that fall into each category for specific subfields of biology.

Information Control Agencies

Many agencies have come into existence over the years -- some private and some government-sponsored -- for the express purpose of maintaining control over the information in particular subject areas. While you would of course not begin a search for information by consulting one of these agencies, you should be aware that they are available to help you if you have trouble locating enough information on a topic or if you have serious questions about the accuracy of some of the information you do find. The National Referral Center at the Library of Congress has prepared a directory of special information agencies in the field of biology. Published in 1972, A Directory of Information Resources in the United States: Biological Sciences lists each agency alphabetically by its name and discusses its particular areas of interest, holdings, publications, and information services. A detailed subject index is included. Four of the major national agencies that can be consulted for biological information are listed in the biology bibliography.

The Organization of the Discipline

In every subject area there are introductory texts designed to define the discipline and to outline and briefly discuss all of the subtopics into which the discipline may be divided. These texts are valuable in that they put

each topic -- no matter how broad or narrow -- into perspective, give fundamental substantive background information, and usually provide a basic bibliography for further reading.

Guides to the Literature

Whereas textbooks give an overview of the subject matter of a discipline and its subtopics, there are other works designed to outline and survey the available sources of information. While they may at first glance appear to be basically annotated bibliographies, these guides "usually go beyond the normal limits of enumerative bibliography in including not merely lists of references but discussions of the functions and uses of the various types of literature."[1] The sources are usually presented in categories similar to the ones used in this handout. A good basic discussion of the primary, secondary, and tertiary sources in the sciences is given in the article "Literature of Science and Technology" in the McGraw-Hill Encyclopedia of Science and Technology.

Guides to Research Methods

While this handout is primarily concerned with how to look up information about what others have done or discovered, you should be aware of some items designed to introduce one to the principles and methods of original research. Even if you do no research yourself, an understanding of the basics of research will help you to appreciate what the authors you read went through before they were able to publish.

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[1]Denis Joseph Grogan, Science and Technology: An Introduction to the Literature, 3d ed. (Hamden, Conn.: Linnet Books, 1976), p. 30.

History

Usually one wishes to find the most current information available on a topic. In some instances, however, it is desirable to know about the failures and successes of the past which have led up to the present state of knowledge. There is so much historical information in the field of biology, in fact, that an annotated bibliography has been prepared (Pieter Smit's History of the Life Sciences).

The categories of information sources discussed so far form a foundation from which one can begin to search for information on a specific topic in the field of biology. Your primary concern, however, is probably with the practical problem of how to start from scratch and locate useful information on a particular topic. The remaining categories will address themselves directly to that problem and will be presented in the order in which they should be consulted. A discussion of "Search Strategy" near the end of this handout will summarize the logical and systematic approach to the information-seeking process.

Dictionaries

The first step in looking for information on a topic is to clarify the terminology involved. There are many words that mean entirely different things from one discipline to another. For example, in biology the word "comet" refers to "any of several trochilid birds of the genera Sappho and Polyonymus," but an astronomer would attach a different meaning to the word. Also, there are many new words constantly being "coined" in all of the various disciplines -- and this is especially true in the sciences. So be certain at the very start that you know the meaning of all terms from the standpoint of the discipline of

biology. Many specialized dictionaries are available for you to consult, covering both biology in general and various subfields (e.g., A Dictionary of Genetics or Dictionary of Ecology).

Encyclopedias

After you have clarified the terminology, you need to clarify the concept as a whole. Make sure you know exactly what you are looking for before you begin a detailed search for information. You would very seldom wish to look for information simply on "biology" or even on such subfields as "animal physiology" or "genetics." In fact, practically any topic that is chosen turns out to be more complicated that it first appears. A major problem, then, is to find out what you are letting yourself in for when you choose a particular topic. You need to see how broad the topic actually is and what kinds of problems you would face in dealing with all of the information available on it. If your original topic is found to be unmanageable, you then need to break it down into logical subtopics, one of which can now be concentrated upon. It would also be a great help at this stage in your investigation to obtain a preliminary bibliography which will lead you to further information on the specific topic which you finally choose. The best place to obtain a brief but comprehensive overview of your topic to provide you with this needed background information is a biological encyclopedia. Feature articles in such an encyclopedia outline and summarize the available knowledge about both broad and narrow topics, and the subject index guides you to both entire articles on a topic and mention of a topic in other articles.

Reviews of the Literature and Yearbooks

Once you have narrowed your original topic to something you think you can

handle, it would be nice to have available a summary of the most important and informative books and journal articles that have been written on your subject over the years. A review of the literature does just that; it "takes the form of a critical summary (and possible synthesis) by a specialist of developments in a particular field of endeavor over a given period."[2] A brief discussion of the advantages and disadvantages of these published summaries is found on pages 14 and 15 of the book by Smith and Reid (listed in the biology bibliography under the heading "Guides to the Literature"). A more detailed discussion is given in the article by Julie Virgo. Review articles appear from time to time in practically all of the major biology journals; some of the journals in which they appear most often are listed in the bibliography. In addition to journals, various yearbooks contain both new review articles and updates and supplements to past review articles.

Guides to Locating Books in a Particular Library

The card catalog -- or in some cases, the book catalog -- is a guide to the books contained in a particular library. While the card catalog should be one of the first places you go in the process of looking up information on a topic, it should definitely not be the one and only place you go. Card catalogs have several major limitations:

1. They list for the most part only books (the GSC Library's catalog also includes audio-visual materials, books on microform, and titles of periodicals and periodical indexes). Card catalogs are usually little or no help in locating parts of books, periodical or newspaper articles, government documents, special collections of microforms, or individual plays, poems, short stories, etc.
2. They usually list the books to be found in only one library.

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[2]Ibid., p. 213.

3. The information on the catalog cards is non-evaluative and non-advisory. There is no immediate way to determine which are the "best" books on your topic.

4. The arrangement of the cards may be so complicated from a non-librarian's viewpoint that you may not be able to locate appropriate books even though they are listed in the catalog.

Detailed discussions of how to use a card catalog properly and how to take advantage of the wealth of information to be found on a catalog card are contained in several of the books listed in the bibliography. It is particularly important to learn how to use the Library of Congress Subject Headings books to obtain a list of the most appropriate subject headings before going to the catalog to look up books by subject. In the GSC Library these books are located on top of the Reference Desk, and on one page they indicate the correct headings for a given subject, related headings, narrower headings, and broader headings.

Guides to Parts of Books

The card catalog lists for the most part only one title for each book. Books are constantly being published, however, which are collections of chapters or essays. Within one cover there may be a dozen or more separate writings on a variety of subjects, each by a different author. If there is a chapter on your topic in a book, you will probably not become aware of its existence by consulting the card catalog, bibliographies, or periodical indexes. The Essay and General Literature Index is designed to overcome this problem by indexing each chapter separately by subject. The author and title of the chapter are given, as well as the editor and title of the book that contains the chapter and the pages on which the chapter appears.

Handbooks

A handbook is a compilation of miscellaneous factual information centered around one central theme or subject area. This straightforward factual information

may be presented by means of tables, graphs, charts, chronologies, or various kinds of lists. A handbook should be consulted for quick answers to specific factual questions and for statistical information. Many books with the word "handbook" in the title, however, go far beyond this narrow definition of the term. Unfortunately, there are also some books with "handbook" in the title that are not really handbooks at all.

Indexes, Abstracts, and Guides to the Periodical Literature

Much of the most current information on a topic appears in recent periodical articles (there is, however, often an unfortunate time lag between the writing of an article and its actual appearance in a periodical issue). While a few periodical titles are self-indexing, the best approach to locating articles on a topic is to consult a subject index which covers many different titles. Toward the front of each index is usually a listing of the periodical titles indexed, and Ulrich's International Periodicals Directory lists periodicals by subject and by title and indicates where each is indexed. An abstracting service is similar to an index, but it goes a step further by giving not only the citation to an article but also a summary of the article. The book by Owen and Hanchey discusses the merits of specific indexes and abstracts.

When using a periodical index or abstracting service, several problems should be kept in mind:

1. A great many indexes and abstracts are now available, ranging from the very broad and general to the very narrow and specific. Do not begin with a general index if a more specialized one is available which will provide you with many more citations in a much shorter time.
2. No library can subscribe to every periodical that is indexed, so you may have to use interlibrary loan to obtain copies of some of the important articles which you find cited.
3. Many indexes are not as current as their publication dates might indicate. Because of the time lag between the publication of an article and its citation in an index, the articles cited in an index published in 1977, for example, may have appeared mostly in 1975 and 1976.

4. There is, unfortunately, no standardization of subject headings used in different indexes. You will have to establish a separate list of the most appropriate headings to use for each index title consulted.

5. In order to conserve space, the citations appearing in an index contain many symbols and abbreviations which can be confusing. Tables are provided toward the front of each index, however, which explain these symbols and abbreviations.

All of the indexes and abstracts in the area of the life sciences to which the Library subscribes are listed on the last page of the biology bibliography, but there are a couple of indexes that deserve special mention. Current Contents reproduces the contents pages of issues of periodicals before they are published. This allows you to look out for particular articles and read them as soon as your library receives them. The rationale of Science Citation Index is that the publications an author cites tend to identify earlier writings of significance on the same subject. Of course, when you read a journal article the books and articles consulted by the author are listed in the footnotes and bibliography. What Science Citation Index allows you to do is to pick an article and trace for a given time period where that article was cited. There is a Source Index which gives the bibliographical information about articles which cite earlier articles, a Citation Index which is arranged by the authors of cited articles, and a Permuterm Subject Index for the subject approach.

The single most useful scholarly index for the field of biology is Biological Abstracts. Each issue contains information about its coverage, arrangement, and use. There is an Author Index by personal or corporate name, a Biosystematic Index by broad taxonomic categories, a Generic Index by genus-species names, a Concept Index by broad subject concepts, and a Subject Index by specific key words. A computer search of Biological Abstracts and Bioresearch Index may be obtained by consulting a reference librarian.

Theses, Dissertations, and Research Reports

Some of the most scholarly, in-depth information on a topic is contained

in theses and dissertations written for academic degrees and in reports of research sponsored by government agencies, foundations, academic institutions, private industry, etc. Unfortunately, most of these theses, dissertations, and research reports are never published, so there is a twofold problem of finding out that one exists on your topic and then of seeing the text. There are special resources which index these ephemeral works by subject and, in some cases, provide an abstract of the contents. A few of these indexes also provide information about how to obtain a copy of the complete text.

Conference Proceedings and Publications of Societies

While they are published, the proceedings of conferences (these meetings may also be called conventions, symposia, seminars, sessions, assemblies, workshops, round tables, clinics, institutes, colloquies, etc.) on a topic and the monographs and other publications of societies, institutions, and foundations are not treated adequately in bibliographies and may be overlooked in a library's card catalog. One of the reasons for this problem is that these publications tend to be treated as parts of series rather than as individual works. Some aids to bibliographical control over these publications are listed in the bibliography.

Guides to Research in Progress

In the field of biology, there are very few works devoted to research still in progress. Some coverage is given in a few biological journals.

Guides to Government Documents

Government documents contain a wealth of valuable information on a variety of subjects, including a great deal in the area of the life sciences. In many libraries (including the one at GSC) documents are kept in a separate

collection and are not listed in the card catalog. The best way to locate documents on a given topic, therefore, is by means of the Monthly Catalog of United States Government Publications. This publication indexes documents by author (or agency), title, and subject. Since Library of Congress subject headings are now used in the Monthly Catalog, approach the subject index initially with the same headings you used to find books. You may find, however, that you will have to use broader headings to locate appropriate documents in the desired subject area.

If, for example, you were looking for information on possible dangers of blood transfusions you could begin by consulting one of the cumulative subject indexes to the Monthly Catalog. The semi-annual index for July-December 1976 lists under the heading "Blood -- Transfusion" a document entitled Hepatitis from Blood Transfusions and gives the number "76-590." The cover of the July 1976 issue of the Monthly Catalog indicates that it contains "entry" numbers 76-1 to 76-1433, so the full description of the document you found listed in the index will be the 590th one listed in this issue. From the description it can be determined that this document is a 106-page paperback report which may be purchased for $1. If the Library has a copy it can be located on the shelves in the documents area by its Superintendent of Documents classification number, which in this case is given as "GA 1.13:MWD-75-82." If you need help in using the documents collection, consult someone in the Documents Office or at the Reference Desk.

Bibliographies of Bibliographies

Whenever you need to go beyond the resources of the libraries whose collections are conveniently accessible to you to locate books or other sources of information on a topic, special bibliographies should be consulted. The "information explosion," however, has resulted in not only a large number of books but also a great many bibliographies. You may, therefore, wish to begin

with a bibliography of bibliographies, keeping in mind that it is two times removed from an actual book which can be read.

Bibliographies

Bibliographies are lists of books (periodical articles are sometimes included) on a given subject or developed around some common theme. The McGraw-Hill publication is devoted entirely to science and technology, with a section on biology. Other useful lists of books in the field of biology are contained in the works listed in the "Guides to the Literature" section of the bibliography which accompanies this handout. As they are published throughout the world, all books in the English language are listed in the Cumulative Book Index. Titles cataloged by the Library of Congress are listed in its Subject Catalog, and books still available for purchase from the publishers are indicated in the Subject Guide to Books in Print. Books which the GSC Library does not own may be borrowed by means of the Interlibrary Loan service.

Book Reviews

Once you locate a book on a topic, you may wish to check on the general reliability of the information it contains. Book reviews by experts in the subject area give an indication of the value of the book's contribution to knowledge in the field. Most such book reviews are written within a year of the book's publication.

Biographical Sources

While all scientific writing should be totally objective, one cannot help but be influenced by his background and by his present physical, social, and intellectual environments. "So intimately bound up with his personal life

is the work of a research scientist that a full understanding of his achievements often demands close study of his biography."[3] Delving into scientific biography is often not only necessary but also quite interesting.

Style Manuals and Guides to Scientific Writing

Once sufficient information on a topic is gathered, it must be read, digested, organized, and incorporated into some kind of paper or report of your own. Aids to this process are listed in the bibliography.

Search Strategy

As mentioned earlier, the various categories of information sources have been discussed in a logical, step-by-step order which, if followed, will allow you systematically to build up a body of information about any given topic. The chapter by Thomas Kirk includes a flowchart which visualizes the correct approach to searching for biological information. The book by Parker and Turley, which is in one sense a guide to the literature, is organized around a "plan of action" for locating scientific and technical information, and the work by Doyle and Grimes discusses the process of seeking information by means of a "bibliographic chain." There is also a brief but good discussion of "searching the literature" in the book by Smith and Reid listed in the bibliography under "Guides to the Literature."

In summary, an effective search strategy for locating information on a particular topic involves:

1. Clarifying terminology by using specialized dictionaries.

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[3]Ibid., p. 329.

2. Clarifying and narrowing the concept and obtaining an overview of the topic by consulting specialized encyclopedias.

3. Surveying the most important writings on the topic over a given time period by reading a review of the literature.

4. Locating the books on the topic in a particular library by proper use of the Library of Congress Subject Headings books and the card catalog.

5. Locating parts of books that might be helpful.

6. Consulting handbooks for brief factual information.

7. Using the most appropriate indexes and abstracting services as guides to the periodical literature.

8. Looking for information about theses, dissertations, and research reports that might prove valuable.

9. Locating conference proceedings and publications of societies which contain information pertinent to your topic.

10. Obtaining information about research in progress.

11. Using the government documents collection.

12. Finding out about other books that are available by using bibliographies of bibliographies and bibliographies.

13. Reading book reviews and obtaining biographical information about the authors.

The purpose of discussing categories of information sources and search strategy has been to help you bring some order out of the apparent chaos that confronts you when you approach the massive resources of a library to find information on a particular topic. It is not the purpose of this handout to make you entirely self-sufficient in your information seeking, and you are encouraged to seek help from a reference librarian when you have any problem -- great or small -- using a library.

The remaining miscellaneous categories covered in the bibliography are not directly related to the process of locating information on a given topic and so will not be discussed in the text of this handout, but they include information sources which are useful to both the student and teacher of biology.

GEORGIA SOUTHERN COLLEGE LIBRARY
A Selected Guide to Information Sources in
Biology
revised August 1979

Information Control Agencies

National Agricultural Library. 10301 Baltimore Blvd., Beltsville, Maryland 20705. Phone: 301-344-3750.

National Library of Medicine. 8600 Rockville Pike, Bethesda, Maryland 20014. Phone: 301-496-6221.

National Referral Center for Science and Technology. Library of Congress. Washington, D.C. 20540. Phone: 202-426-5670.

Smithsonian Science Information Exchange. 1730 M Street, N. W., Washington, D.C. 20036. Phone: 202-381-4211.

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Jessop, Nancy Meyer. Biosphere: A Study of Life. Englewood Cliffs, N.J.: Prentice-Hall, 1970. QH/308.2/J47

Keeton, William T. Biological Science. New York: Norton, 1967. QH/308/K38

Simpson, George Gaylord and Beck, William S. Life: An Introduction to Biology. 2d ed. New York: Harcourt, Brace & World, 1965. QH/308/S53/1965

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Bottle, Robert T. and Wyatt, H. V. The Use of Biological Literature. 2d ed. Hamden, Conn.: Archon Books, 1971. (not in the GSC Library)

Caldwell, Synton Keith. Science, Technology, and Public Policy: A Selected and Annotated Bibliography. 3v. Bloomington: Indiana University, 1968-1972. Ref/Z/7405/H6/C342

Chen, Ching-chih. Scientific and Technical Information Sources. Cambridge, Mass.: MIT Press, 1977. Ref/Z/7401/C48

Grogan, Denis Joseph. Science and Technology: An Introduction to the Literature. 2d ed. Hamden, Conn.: Linnet Books, 1973. Q/223/G76/1973 (There was a third edition published in 1976, but it is not in the GSC Library)

Herner, Saul. A Brief Guide to Sources of Scientific and Technical Information. Washington: Information Resources Press, 1969. (not in the GSC Library)

Jenkins, Frances Briggs. Science Reference Sources. 5th ed. Cambridge, Mass.: MIT Press, 1970. Ref/Z/7401/J4/1970

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Lasworth, Earl James. Reference Sources in Science and Technology. Metuchen, N.J.: Scarecrow Press, 1972. Ref/Z/7401/L36

McGraw-Hill Encyclopedia of Science and Technology, 4th ed. S.v. "Literature of Science and Technology," by George S. Bonn. Ref/Q/121/M3/1977/v.7

Malinowsky, Harold Robert. Science and Engineering Reference Sources. Rochester, N.Y.: Libraries Unlimited, 1967. Ref/Z/7401/M28 (There was a second edition published in 1976 entitled Science and Engineering Literature, but it is not in the GSC Library)

Sheehy, Eugene Paul. Guide to Reference Books. 9th ed. Chicago: American Library Association, 1976. Ref/Z/1035.1/S43/1976

Smith, Roger Cletus and Reid, W. Malcolm. Guide to the Literature of the Life Sciences. 8th ed. Minneapolis: Burgess, 1972. Ref/Z/5320/S57/1972

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Beveridge, William Ian Beardmore. The Art of Scientific Investigation. London: Heineman, 1970. Q/180/A1/B48/1970

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Locy, William Albert. Biology and Its Makers. 3d ed. New York: H. Holt, 1934. QH/305/L7/1935

Mazzeo, Joseph Anthony. The Design of Life: Major Themes in the Development of Biological Thought. New York: Pantheon, 1967. QH/305/M27

Nordenskiold, Erik. The History of Biology: A Survey. New York: Knopf, 1928. QH/305/N6

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